

Improvements in Outcomes and Disparities of ST-Segment–Elevation Myocardial Infarction Care

The Miami-Dade County ST-Segment–Elevation Myocardial Infarction Network Project

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Goals and Vision of the Program

The strategy of primary percutaneous coronary intervention (PCI) for ST-segment–elevation myocardial infarction (STEMI) has led to major outcome improvements in this patient population, and within this strategy, early reperfusion remains a critical component for improved survival. Although outcomes after percutaneous revascularization have improved, disparities in cardiovascular care remain an important challenge, particularly in large metropolitan areas in the United States. The Miami-Dade County STEMI Network is an Emergency Medical Services (EMS)–led program established in 2007 with the goal to improve quality of care for patients with STEMI by reducing time from 911 contact to reperfusion.

Local Challenges in Implementation

South Florida has a unique patient population with diverse ethnic and racial backgrounds, highest proportion of older adults as compared with other states, and with women outnumbering men at older ages.¹ A probability-sampled, household-based survey in Miami-Dade County found that non-Hispanic whites constitute only 9.4% of the population with the majority being blacks, Hispanic, or Haitian blacks (non-English speaking ≈37.8%).¹ In this population, 53% of the residents had high school equivalent (or less) degree as formal education, and 34.5% were below the US poverty threshold.¹ Furthermore, one quarter of all households had at least 1 member who was uninsured at some point, and 3 of 5 households had at least 1 member who used Medicare for coverage. Although potentially significant component of disparities is related to patients' clinical characteristics and socioeconomic factors, these vulnerable groups are at increased risk for suboptimal care, particularly for patients with cardiovascular disease. In a random sample from South Florida, one quarter of all households had at least 1 member who had a heart attack

or acute cardiovascular illness within 5 years of the study.¹ Within Miami-Dade County and South East Florida, the presence of 6 EMS response systems with different directors and administrative staff, the large number of hospital systems (academic/teaching, and nonteaching hospitals) equipped with cardiac catheterization laboratories (total number of hospitals with catheterization laboratory able to perform PCI in South Florida=21), and a large number of providers can result in variability in practice and a significant challenge toward standardization and optimization of care. In addition, although PCI was the standard of care at the time, EMS systems could still transport patients to hospitals without cardiac catheterization capabilities. In an analysis of 63 184 patients with STEMI admitted to Florida hospitals between 2001 and 2005, 13 550 patients were admitted to a non-PCI capable hospital.² Among those who were admitted with STEMI to PCI-capable hospitals, the in-hospital mortality was 13% for those who did not receive same-day PCI (versus 1.9% for those who received same-day PCI), which indicates significant heterogeneity in STEMI care during that period.² Mortality rates were also higher in women, in elderly patients, and in patients receiving thrombolysis.

Design of the Initiative

As part of the national initiative to improve care for patients with STEMI in 2006, the 6 Fire Rescue Departments in Miami-Dade County agreed to commit to excellence in care for patients with STEMI by applying standardized medical protocols. The primary objectives were rapid recognition of STEMI, time focused initiation of treatment modalities including aspirin, oxygen, and nitroglycerin, and a strong emphasis on continuous quality improvement. In December 2006, a letter was mailed to the CEOs of 12 PCI-capable hospital systems asking to enroll in a voluntary program to adhere to quality metrics

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(*Circ Cardiovasc Qual Outcomes*. 2017;10:e004038. DOI: 10.1161/CIRCOUTCOMES.117.004038.)

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Circ Cardiovasc Qual Outcomes is available at <http://circoutcomes.ahajournals.org>

DOI: 10.1161/CIRCOUTCOMES.117.004038

for STEMI care, including door-to-balloon times (D2BT). In February 2007, the 6 Fire Rescue Departments in Miami-Dade County, FL, organized a conference with the CEOs of the 12 hospitals to explore the development of a Miami-Dade County STEMI Network aimed toward improving times to reperfusion for patients with STEMI. Participation to the Network required signing by each CEO a performance contract with a commitment to adhere to quality standards for STEMI care about times to reperfusion and collection of self-reported data for every patient treated in each hospital system. Data collection included a standardized data form for each patient with STEMI, signed by the local cardiac catheterization laboratory representative, and sent via US mail to the EMS coordinating center, and a validation process with (1) review of electronic healthcare record for each patient and (2) cardiac catheterization laboratory records and logs sent via US mail to the EMS coordinating center for further review. In March 2007, the program was officially launched with enrollment of patients with STEMI and implementation of data collection. Hospital participation in the STEMI Network required a commitment to provide timely PCI, defined as a D2BT of <60 minutes, and an ED elapsed time of <20 minutes. If a hospital system did not choose to participate in the program, patients with STEMI would not be transported to that institution by the EMS. The EMS coordinating center prepared quarterly reports including aggregate network data and individual hospital patients' level data and quality metrics and mailed the reports to each participating hospital. If a participating hospital did not meet quality metrics, a letter was sent to the CEO of the hospital outlining the specific deviations and requesting corrective actions. Lack of response with corrective action within 30 days and continued or recurrent suboptimal metrics resulted in suspension of the hospital from the network, and patients with STEMI would no longer be transported to the index hospital. Development and implementation of corrective actions, as well development of the optimal process of care for patients with STEMI, were left to the individual hospital. From the EMS perspective, particular emphasis was placed on initial diagnosis and emergency treatment of STEMI and EMS activation of the cardiac catheterization team based on the field ECG. Interventional cardiologists taking STEMI calls in network hospitals received additional compensation for each call.

The Miami-Dade County STEMI Network currently consists of a coalition of 6 jurisdictional fire departments with 95 fire stations and ≈3000 paramedics. It provides guideline-directed standard emergency medical response to residents of Miami-Dade County. Furthermore, the EMS medical directors of the STEMI Network coordinated rigorous training in ECG interpretation for all paramedics enrolled in the program. In participating hospitals, the cardiac catheterization laboratory is activated based on paramedic diagnosis of STEMI. Patients with cardiogenic shock and those who require invasive mechanical ventilation are excluded. Data analysis was performed after execution of a memorandum from the Miami Mayor to the Board of Commissioners asking to authorize analysis and publication of the data collected (Memorandum and resolution at <http://www.miamidade.gov/govaction/legistarfiles/Matters/Y2014/141269.pdf>; last access date June 21, 2017).

Implementation of the Initiative

Initially, 2 hospital systems declined to participate. However, these 2 hospitals joined the Network within the first year of the quality initiative. One hospital that agreed to participate in the program was unable to adhere to the quality metrics. That hospital was terminated from the program. After correction of the underlying deficits in adherence to quality metrics, the hospital was allowed to rejoin the program. Three new hospitals were added between 2011 and 2015, and the network includes a total of 15 hospitals providing primary PCI for patients with STEMI.

From April 2007 through December 2015, 5507 patients had STEMI and received primary PCI in Network hospitals. Poisson regression was used to assess trends over time. Among these patients, 1472 (27%) were female and 1174 (21%) were ≥75 years old. The majority of patients were Hispanic (Hispanic=71%; white=17%; black=9%). The median age of the cohort was 62 years (interquartile range, 53, 73).

Before implementation of the STEMI Network, we were not aware of disparities in quality metrics of STEMI care among subpopulations in the community. However, during the initial time period from 2007 to 2009, D2BT differed between men and women (62.5 versus 60; $P=0.031$), subjects ≤75 versus >75 years of age (60 versus 63; $P=0.004$), and whites versus blacks (59 versus 68; $P=0.02$). Among racial/ethnic minorities, ED time, femoral access, and D2BT in 2007 were longest among blacks while Hispanics had similar times to whites.

Success of the Initiative

During implementation of the program (from 2007 to 2015), there was a progressive improvement in median time metrics, including EMS to ED time (37 versus 31 minutes; $P<0.001$); ED elapsed time (30 versus 16 minutes; $P<0.001$); ED to vascular access time (50 versus 34 minutes; $P<0.001$); and D2BT (61 versus 46 minutes; $P<0.001$). In addition, all time metrics improved for women (ED time: 35 versus 16 minutes; vascular access time: 53 versus 36 minutes; D2BT: 65 versus 47.5 minutes) and older adults (ED time: 35 versus 16.5 minutes; vascular access time: 56 versus 34 minutes; D2BT: 68 versus 49 minutes). Time metrics improved significantly across different ethnic and racial groups over time ($P<0.001$; Figure A and B). By 2012 to 2015, the significant improvements achieved in all time metrics resulted in no remaining differences based on sex, age, or race/ethnicity.

Translation to Other Settings

Disparities in STEMI care among vulnerable subpopulations seem to remain a significant challenge in the United States,³ including delays in STEMI recognition, time-to-reperfusion, and lower use of evidence-based care among ethnic/racial minorities. Possible explanations for prior EMS time delays include language barriers, lower socioeconomic status, and underutilization of specialized EMS systems trained to achieve national guidelines' quality metrics.³ Implementation of a specialized system of care resulted in dramatic improvements in quality metrics across all patient subpopulations and resolution of disparities in care. Coordination of fire rescue departments and hospitals throughout metropolitan regions

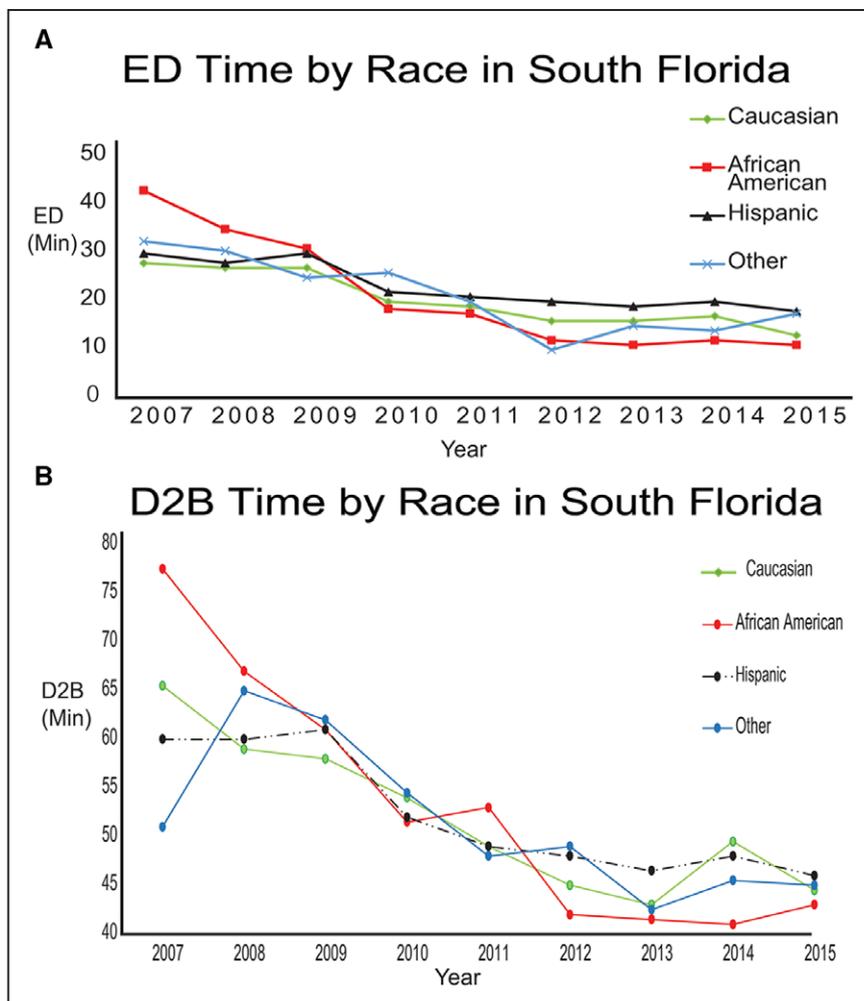


Figure. A, Emergency department (ED) elapsed time. **B**, Door-to-balloon time (D2B) by race/ethnicity in the Miami-Dade County STEMI Network from 2007 to 2015. STEMI indicates ST-segment-elevation myocardial infarction.

can maximize outreach, achieve fast diagnosis, transport patients in timely manner, and facilitate direct activation of the cardiac catheterization laboratory.

Financial implications for hospital systems can also play an important role in adhering to quality standards. Although a recent study has suggested that Medicare reimbursement for STEMI care might not cover entirely total hospital costs,⁴ the perceived magnitude of lost revenues from losing STEMI designation, the additional negative publicity, and potential loss of revenues for ancillary care and for care of other patients with acute coronary syndromes can be an important drive for institutions to meet and adhere to quality standards.

We think that these results can potentially be translated to other large metropolitan regions with vulnerable populations at risk for suboptimal cardiovascular care.

Summary of the Experience, Future Directions, and Challenges

In conclusion, coordination of EMS and hospital-based systems of care through the development of a standardized EMS-led network was associated with an overall improvement in quality metrics and identification and reversal of disparities across subpopulations of STEMI care. This is a novel approach to optimization of care through a policy intervention addressing standardization of initial STEMI care by EMS, transportation of patients with STEMI to hospital systems committed

to meeting quality standards, and requiring accountability for quality care by hospital CEOs. Most importantly, although other programs have focused on pay for performance or pay for participation, this program was focused on a new paradigm based on performance for participation in care, where hospitals were not allowed to provide care if they could not demonstrate optimal performance. It should be noted that this intervention was focused on reducing time-to-treatment and not reducing disparities, which was a secondary benefit that occurred as the intervention was rolled out. These results are consistent with the goals of the American Heart Association's Mission LifeLine Program and indirectly with EMS strategies recommended in the Institute of Medicine's report on the status of cardiac arrest in the United States.⁵ Data on the proportion of patients with STEMI who died out of hospital as well as the in-hospital and 30-day mortality were not systematically collected as part of this quality improvement initiative. It can be hypothesized that important subgroups may not have made it to the hospital or even after intervention did not do well. Future quality initiative programs should incorporate preadmission and postdischarge outcomes for populations at risk for disparate care. Despite this limitation, reporting the success of innovative programs to enhance quality care for vulnerable subpopulation, such as the Miami-Dade County STEMI Network, remains critical for the overall improvement of the US healthcare system. Future directions may involve

the expansion of systems of care to include other acute cardiovascular conditions, such as sudden cardiac death, acute aortic syndromes, and stroke.⁵

Acknowledgments

We acknowledge the Miami-Dade STEMI Network including (1) 15 hospitals providing acute cardiovascular care in South Florida and (2) 6 Fire Rescue Departments (Miami-Dade County, City of Miami, Hialeah, Miami Beach, Coral Gables, Key Biscayne) for their commitment to improve healthcare quality in South Florida.

Sources of Funding

Dr Myerburg is supported, in part, by the American Heart Association Chair in Cardiovascular Research and by a research grant from the Miami Heart Research Institute, Miami, FL.

Disclosures

Dr Moscucci received book royalties from Wolters Kluwer Lippincott Williams & Wilkins and has stock ownership in Gilead Sciences, Inc. The other authors report no conflicts.

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KEY WORDS: cardiac catheterization ■ emergency medical services ■ percutaneous coronary intervention ■ ST elevation myocardial infarction ■ standard of care

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Circ Cardiovasc Qual Outcomes. 2017;10:

doi: 10.1161/CIRCOUTCOMES.117.004038

Circulation: Cardiovascular Quality and Outcomes is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

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Print ISSN: 1941-7705. Online ISSN: 1941-7713

The online version of this article, along with updated information and services, is located on the World Wide Web at:

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